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U. S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

VEI0318PUSA

U. S. APPLICATION NO. (if known, see 37 C.F.R. 1.5)

09/445356

INTERNATIONAL APPLICATION NO.
PCT/FR98/00811INTERNATIONAL FILING DATE
08 April 1999 (08.04.99)PRIORITY DATE CLAIMED
10 April 1998 (10.04.98)

TITLE OF INVENTION A METHOD OF MAKING A SANDWICH-TYPE COMPOSITE PANEL HAVING
A HINGE, AND A PANEL OBTAINED BY PERFORMING SUCH A METHOD

APPLICANT(S) FOR DO/EO/US

Nicolas Hochet and Francis Vendangeot

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☐ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☐ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
 - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☒ has been transmitted by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☐ Amendments to the claims of the International Application Under PCT Article 19 (35 U.S.C. 371(c)(3))
 - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ have been transmitted by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☐ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

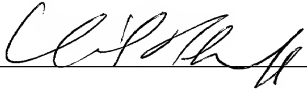
Items 11. to 16. below concern document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A **FIRST** preliminary amendment.
☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☐ Other items or information:

"Express Mail" mailing label No.: EJ 124 053 725 USDate of Deposit: December 10, 1999

I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" under 37 C.F.R. 1.10 on the date indicated above and is addressed to: P.O. Box PCT, Assistant Commissioner for Patents, Washington, D.C. 20231

Linda J. Robb
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U.S. APPLICATION NO. (If known, see 37 C.F.R. 1.5) 09/445356		INTERNATIONAL APPLICATION NO. PCT/FR99/00811		ATTORNEY'S DOCKET NUMBER VEI0318PUSA	
17. <input checked="" type="checkbox"/> The following fees are submitted: BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(5)): Search Report has been prepared by the EPO or JPO \$840.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) \$670.00 No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) \$760.00 Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$970.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) \$96.00 ENTER APPROPRIATE BASIC FEE AMOUNT =				CALCULATIONS <small>PTO USE ONLY</small>	
				\$	840.00
Surcharge of \$130.00 for furnishing the oath or declaration later than ____ 20 ____ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				\$	00.00
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	20 - 20 =	0	X \$18.00	\$	00.00
Independent claims	2 - 3 =	0	X \$78.00	\$	00.00
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ \$260.00	\$	260.00
TOTAL OF ABOVE CALCULATIONS =				\$	1,100.00
Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28).				\$	00.00
SUBTOTAL =				\$	1,100.00
Processing fee of \$130.00 for furnishing the English translation later than ____ 20 ____ 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				\$	00.00
TOTAL NATIONAL FEE =				\$	1,100.00
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property				\$	00.00
TOTAL FEES ENCLOSED =				\$	1,100.00
				Amount to be: refunded	\$
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a. <input checked="" type="checkbox"/> A check in the amount of \$ <u>1,100.00</u> to cover the above fees is enclosed. b. _____ Please charge my Deposit Account No. <u>02-3978</u> in the amount of \$ _____ to cover the above fees. A duplicate copy of this sheet is enclosed. c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. <u>02-3978</u> . A duplicate copy of this sheet is enclosed.					
NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.					
SEND ALL CORRESPONDENCE TO: MR. DAVID R. SYROWIK BROOKS & KUSHMAN P.C. 1000 TOWN CENTER, 22 ND FLOOR SOUTHFIELD, MI 48075 PHONE: (248) 358-4400 FAX: (248) 358-3351					
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09/445356

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

Group Art Unit:

Nicolas Hochet, et al.

Examiner:

Serial No.: Unknown

Filed: Herewith

For: A METHOD OF MAKING A SANDWICH-TYPE
COMPOSITE PANEL HAVING A HINGE, AND A PANEL
OBTAINED BY PERFORMING SUCH A METHOD

Attorney Docket No.: VEI0318PUSA

FIRST PRELIMINARY AMENDMENT

Hon. Commissioner of Patents
and Trademarks
Box PCT
Washington, D.C. 20231

ATTENTION: RO/US

Sir:

Prior to calculating the filing fee and prior to examination on the merits, kindly
amend the claims as follows:

In The Claims

3. (Amended) A method according to claim 1[or 2], characterized in
that the incision (104) is made by means of a serrated blade(200) which, relative to the plane
of said panel (100), firstly moves vertically only so as to penetrate into the skin (101) of said

CERTIFICATE OF EXPRESS MAILING UNDER 37 C.F.R. § 1.0

I hereby certify that this FIRST PRELIMINARY AMENDMENT and the documents referred to as attached therein are
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December 10, 1999
Date of Deposit

Linda Robb

Linda J. Robb
Signature

panel, and then moves vertically and horizontally back-and-forth so as to cut through the cellular core (102).

4. (Amended) A method according to claim 1 [or 2], characterized in that the incision (104) is made by means of two juxtaposed serrated blades (201, 202) which vibrate relative to each other while simultaneously moving downwards vertically relative to the plane of said panel (100) so as to penetrate into said panel by cutting through a skin (101) and through the cellular core (102) thereof.

5. (Amended) A method according to [any one of claims 1 to 4] claim 1, characterized in that the incision (104) is made in the formed panel while said panel is still in the forming mold.

6. (Amended) A method according to [any one of claims 1 to 4] claim 1, characterized in that the incision (104) is made in the formed panel outside the forming mold.

10. (Amended) A method according to [any preceding] claim 1 or claim 7, characterized in that, prior to forming said panel (100) a pre-assembly constituted by the stack of at least the first skin (101), of the cellular core (102) and of the second skin (103) is heated.

11. (Amended) A method according to [any one of claims 1 to 10] claim 1 or claim 7, characterized in that, while said panel (100) is being formed, the first and second skins (101, 103) have a forming temperature lying approximately in the range 160°C to 200°C.

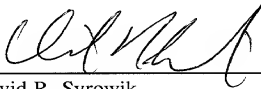
12. (Amended) A method according to [any one of claims 1 to 11] claim 1 or claim 7, said method being characterized in that the first and second skins (101, 103) are made up of glass fiber fabric and of a thermoplastics material.

14. (Amended) A method according to [any one of claims 1 to 13] claim 1 or claim 7, characterized in that the cellular core (102) of the panel (100) has an open-celled structure of the tubular or honeycomb cell type.

15. (Amended) A panel (100) of sandwich-type composite structure and comprising a stack made up of at least a first skin (101) made of a reinforced thermoplastics material, of a cellular core (102) made of a thermoplastics material, and of a second skin (103) made of a reinforced thermoplastics material, the panel being provided with at least one hinge, and being made by implementing the method according to [any one of claims] claim 1 [to 14] or claim 7.

Respectfully submitted,

Nicolas Hochet, et al.

By 

David R. Syrowik

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Date: December 10, 1999

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1/ PRTS
A METHOD OF MAKING A SANDWICH-TYPE COMPOSITE PANEL HAVING
A HINGE, AND A PANEL OBTAINED BY PERFORMING SUCH A METHOD

The present invention relates generally to panels of
sandwich-type composite structure having a cellular core,
5 in particular for motor vehicles, and more particularly
to a method of making such a panel provided with a hinge.

Sandwich-type materials having cellular cores have
very important characteristics resulting from their being
light in weight.

10 Conventionally, such a panel is constructed by
sandwiching a cellular core having low strength
characteristics by gluing it or welding it between two
skins, each of which is much thinner than the cellular
core but has excellent mechanical characteristics.

15 In addition, the Applicant's document FR 2 711 573
discloses a method of making a panel of sandwich-type
composite structure having a cellular core. In that
method, said panel is made in a single step by subjecting
a stack to cold-pressing in a mold, which stack is made
20 up of at least a first skin made of a stampable
reinforced thermoplastics material, of a cellular core
made of a thermoplastics material, of a second skin made
of a stampable reinforced thermoplastics material, and of
a first external covering layer made of a woven or non-
25 woven material, said skins being pre-heated outside the
mold to a softening temperature.

Such a method is particularly advantageous because
of the fact that it makes it possible, in a single
operation, to generate cohesion between the various
30 layers of the composite structure, and to shape said
panel.

The resulting panel conserves all of the mechanical
properties imparted by the cellular-core sandwich
structure.

35 Panels of sandwich-type composite structure having a
cellular core have rigidity characteristics sufficient to
enable mechanical structures subjected to large stresses

to be reinforced structurally without making them too heavy. Such panels are in common use in shipbuilding, aircraft construction, and rail vehicle construction.

However, such panels are rarely used as such.

5 To maximize the functionality of such panels, it is known, in particular, that hinges can be added so that the panels can be hinged to other panels. Such hinges are separate parts that are fixed to the panels by gluing, welding, riveting, or some other fastening
10 technique.

Such hinges are fixed to the sandwich-structure composite panels in a separate and subsequent operation, after said panels have been formed. That subsequent operation requires an additional workstation, be it
15 automated or otherwise, which increases, in particular, the manufacturing time and the manufacturing cost of the finished parts.

In addition, the fact that separate external parts are mounted on a composite panel of the sandwich type is
20 a source of quality defects, and thus adds to the cost of making such panels.

To mitigate the drawbacks of the above-mentioned state of the art, the invention proposes a novel method of making a composite panel of sandwich structure and
25 provided with a hinge, which method is simple to implement, requires no additional subsequent operation, and thus makes it possible to manufacture such parts at a reasonably low cost.

More particularly, the invention provides a method
30 of a method of making a composite panel of sandwich structure and provided with a hinge, said panel comprising a stack made up of at least one first skin made of a reinforced thermoplastics material, of a cellular core made of a thermoplastics material, and of a
35 second skin made of a thermoplastics material, in which method said panel is formed by pressing said stack at a pressure lying in the range 10×10^5 Pa to 30×10^5 Pa,

the first and second skins being preheated to a softening temperature.

The method is characterized in that, after said panel has been formed, an incision is made at a
5 determined place in said panel so as to cut through one of the first and second skins, and substantially through the entire thickness of the cellular core, while leaving the other skin intact so that it forms, at said place, the hinge between two portions of the incised panel.

10 The expression "substantially through the entire thickness of" is used to mean that the cellular core is cut through over a distance lying in the range 80% of its total thickness to 100% of its total thickness..

The method of the invention goes against the
15 preconceptions of the person skilled in the art who believes that, if the structural integrity of the sandwich material is not maintained, it will not retain all of its mechanical capacities, and who believes that a skin made of a thermoplastics material reinforced with
20 glass fibers, carbon fibers, or natural fibers is not strong enough to constitute a structural hinge because of the use of fibers.

It is known that a thermoplastics material can be used to make a hinge that does not provide structural
25 strength or at least not much structural strength, but, in the mind of the person skilled in the art, adding glass fibers to a thermoplastics material makes it too weak to use for this function.

The invention also provides a method of this type
30 for making a composite panel of sandwich structure and provided with a hinge, said method being characterized in that, simultaneously with the forming of said panel, at least a portion of an edge of said panel is crushed so as to compact the cellular core, and the crushed portion
35 of the edge is cut out to a desired shape so as to obtain a hinge-forming piece suitable for being fixed to another panel.

In an advantageous implementation of the above-mentioned method, the crushed-edge portion is cut out at the end of forming of said panel.

In a variant, the crushed edge portion is cut out immediately after said panel has been formed.

In order to make this hinge using the method of the invention, the principle that governs the making of a sandwich material, whereby the required spacing between the skins must be maintained, is disregarded, but the crushing of the edge of the panel makes it possible to increase its traction strength considerably because the sheared area of said edge is thus statistically increased, by removing the empty spaces in the cellular core.

According to other non-limiting and advantageous characteristics of the method of the invention, prior to forming said panel, a pre-assembly constituted by the stack of at least the first skin, of the cellular core and of the second skin is heated such that, while said panel is being formed, the first and second skins have a forming temperature lying approximately in the range 160°C to 200°C.

The first and second skins are made up of glass fiber fabric and of a thermoplastics material. The thermoplastics material may be a polyolefin and preferably polypropylene.

The cellular core of the panel advantageously has an open-celled structure of the tubular or honeycomb cell type.

Naturally, in the invention, it is also possible to use a cellular structure having closed cells of the foam type.

The invention also provides a panel of sandwich-type composite structure and comprising a stack made up of at least a first skin, of a cellular core made of a thermoplastics material, and of a second skin, the panel

being provided with at least one hinge, and being made by implementing the above-mentioned method.

The invention and how it may be implemented can be well understood from the following description given with
 5 reference to accompanying drawings which are given by way of non-limiting example, and in which:

Figure 1 is a first embodiment of a sandwich-structure composite panel provided with a hinge, and made using the method of the invention;

10 Figure 2 shows a step in performing an implementation of the method of the invention;

Figure 3 is a side view of a double serrated blade used in the method of the invention;

15 Figure 4 shows a test installation for a sandwich-structure composite panel provided with a hinge, and made using the method of the invention;

Figures 5a and 5b show a sandwich material as crushed and a sandwich material as non-crushed, in which a fixing screw is inserted; and

20 Figure 6 is a diagrammatic front view of a second embodiment of a sandwich-structure composite panel made using the method of the invention.

Figure 1 shows a panel 100 of sandwich-type composite structure made up of a stack comprising a first
 25 skin 101 made of a reinforced thermoplastics material, a cellular core 102, and a second skin 103 made of a reinforced thermoplastics material.

The first and second skins 101, 103 are reinforced with fibers, e.g. glass fibers, carbon fibers or natural
 30 fibers.

The first and second skins 102, 103 may advantageously be made up of woven glass fiber fabric and of a thermoplastics material.

The thermoplastics material is a polyolefin and
 35 preferably polypropylene.

In this example, the cellular core 102 is an open-celled structure of the type made up of tubes or of a

honeycomb, and it is made mainly of polyolefin and preferably of polypropylene. Naturally, it is possible to use a cellular structure having closed cells of the foam type.

5 One side or both sides of the panel 100 may be covered with an outer covering (not shown) made of a woven or non-woven material (of the carpet type).

10 In the method of making such a panel, the panel 100 is formed by pressing a stack in a cold-forming mold, the stack being made up of the first skin 101, of the cellular core 102, and of the second skin 103, and being pressed at a pressure lying in the range 10×10^5 Pa to 30×10^5 Pa.

15 The first and second skins 101, 103 are pre-heated to make them malleable.

20 Advantageously, in order to soften the first and second skins, heat is applied to a pre-assembly constituted by the stack made up of at least the first skin 101, of the cellular core 102, and of the second skin 103 so that, while said panel is being formed, the first and second skins have a forming temperature lying approximately in the range 160°C to 200°C , and, in this example, about 180°C .

25 As shown in Figure 1, the panel 100 is provided with an incision 104 at a determined place that, in this example, is substantially central.

30 This incision 104 is made after the panel 100 has been formed, and more particularly in the range 10 to 30 seconds after it has been formed, so as to cut through the first skin 101 and through substantially the entire thickness of the cellular core 102, while the second skin 103 is left intact so that, at said determined place, it forms a hinge 106 between two portions 107, 108 of the incised panel.

35 A serrated blade 200 (see Figure 2) is advantageously used to make an incision. The size of the

serrations and the height of the blade are functions of the thickness of the sandwich material to be cut.

The serrated blade 200 is mounted to move relative to the plane of said panel 100 as formed, the blade moving vertically initially to cut through the fibers of the top first skin 101 without crushing the sandwich material at this place, and then moving vertically and horizontally back-and-forth relative to the plane of said panel so as to cut through the entire thickness of the cellular core.

The time interval of in the range 10 seconds to 30 seconds between the panel-forming operation and the panel-incision operation enables the thermoformed panel to cool sufficiently for the serrated blade 200 to cut the fibers of said skin properly without crushing the sandwich material.

It is possible to make provision for the incision made in the panel 100 by means of the blade 200 to be effected inside the forming mold or outside the forming mold. When the operation is performed inside the forming mold, the serrated blade 200 is mounted on a moving portion of a portion of the mold that, after the panel has been formed, is displaced relative to the mold so as to effect the panel incision operation.

In a variant of the method of making said panel, it is possible to use two serrated blades 201, 202 (see Figure 3) which vibrate as indicated by arrow E relative to each other, while moving vertically relative to the plane of said panel, so as to make the incision 104 as shown in Figure 1.

It is particularly advantageous to use two serrated blades for cutting a skin that is thick or difficult to cut because of the use of fibers and of the type of its weave.

Tests were conducted in situ on such a panel having a hinge by means of testpieces, such as the one shown in Figure 4. The tests were conducted firstly with panels

in which each of the skins was constituted by woven fabric comprising glass fibers embedded in polypropylene and had a weight per unit area of 915 g/m^2 , and the cellular core had honeycomb cells and was made of polypropylene, and secondly with panels in which each of the first and second skins had a weight per unit area of $1,000 \text{ g/m}^2$.

The serrated blade used for making the incisions in the panels had a thickness of 0.5 mm .
Immediately after compression, the forming mold was opened rapidly so as to insert the blade and fix it on a punch, and then the mold was closed again. The opening and closure times enabled the formed panels to cool sufficiently.

The testpieces (one of which is shown in Figure 4) were fatigue tested by performing opening and closure cycles as indicated by arrow I, the opening amplitude varying from a minimum of 3 degrees to a maximum of 45 degrees.

The test results obtained showed that certain testpieces were torn at the hinge-forming skin after 3,000 cycles because a score line was generated on mounting the testpieces on the test bench.

However, the carpet that covered the skins of said testpieces still held the two portions of panel together.

The testpieces that were not damaged on mounting them on the test bench withstood 30,000 cycles without breaking. This corresponds to about eight openings per day for ten years.

Figure 6 shows another sandwich-type composite panel 100 which comprises a stack made up of at least one first skin made of a reinforced thermoplastics material, of a cellular core made of a thermoplastics material, and of a second skin made of a reinforced thermoplastics material of the same type as those described above. The panel 100 is formed by being pressed at a pressure lying in the range $10 \times 10^5 \text{ Pa}$ to $30 \times 10^5 \text{ Pa}$, said first and second

skins being preheated to a softening temperature so that, while the panel is being formed, they have a temperature approximately in the range 160°C to 200°C.

5 This panel 100 is provided with a hinge 106 cut out in one of its edges 109.

Depending on the method used, after the panel has been formed, at least a portion of the edge 109 of the panel is crushed so as to compact the cellular core 103 at this place. This crushing is performed by a
10 projection provided at the appropriate place on a portion of the mold.

Said edge being crushed causes the sandwich structure to be compacted as shown in diagrammatic section in Figure 5a.

15 This crushed sandwich structure can be compared with the non-crushed sandwich structure shown in Figure 5b.

It can be observed from Figures 5a and 5b which show a screw 400 inserted through each of the sandwich composite structures that, in the crushed composite
20 structure, the shear area of the screw is larger than the shear area of the screw inserted through the non-crushed structure since, in the non-crushed structure, the screw passes through the non-crushed cellular core via one of the cells in the core, and therefore the shear area
25 corresponds merely to the areas of the first and second skins.

Thus, advantageously, in the method of the invention, the fact that a portion of the edge 106 of the panel 100 is crushed makes it possible to increase its
30 traction strength.

In order to form the hinge 106 shown in Figure 6, the crushed edge 109 is cut out to the desired shape.

The crushed edge 109 is preferably cut out at the end of the panel-forming operation, but it may also be
35 cut out immediately after the panel-forming operation, which then makes it necessary for the forming mold to be

30

specially organized to prevent the edge of the panel from being cut at the end of forming of said panel.

The panel 100 then has a hinge 106 formed in one piece with it, and which is suitable for being fixed to
5 another part or to another panel to enable one panel to be hinged relative to the other.

The method mentioned and described above in two of its variants offers the following advantages:

it makes it possible to form a hinge in situ in a
10 sandwich-structure composite panel without any separate subsequent operation being necessary, without using any additional part, or any additional material of the glue type for fixing the additional part, thereby making it possible to reduce considerably the cost of manufacturing
15 the finished part;

the method makes it possible to omit any additional machine of the gluing or welding type; and

it makes it possible to make the panel with its integrated hinge in a time shorter than the time required
20 to make a panel provided with a separate hinge.

The present invention is in no way limited to the implementations described and shown, but rather the person skilled in the art can make any variants thereto that lie within the spirit of the invention.

CLAIMS

- 1/ A method of making a composite panel (100) of sandwich structure and provided with a hinge (106), said panel comprising a stack made up of at least one first skin (101) made of a reinforced thermoplastics material, of a cellular core (102) made of a thermoplastics material, and of a second skin (103) made of a thermoplastics material, in which method said panel (100) is formed by pressing said stack at a pressure lying in the range 10×10^5 Pa to 30×10^5 Pa, the first and second skins (101, 103) being preheated to a softening temperature, said method being characterized in that, after said panel has been formed, an incision is made at a determined place in said panel so as to cut through one (101) of the first and second skins (101, 103), and substantially through the entire thickness of the cellular core, while leaving the other skin (103) intact so that it forms, at said place, the hinge (106) between two portions (107, 108) of the incised panel (100).
- 2/ A method according to claim 1, characterized in that the incision (104) in said panel (100) is made approximately in the range 10 seconds to 30 seconds after said panel has been formed.
- 3/ A method according to claim 1 or 2, characterized in that the incision (104) is made by means of a serrated blade (200) which, relative to the plane of said panel (100), firstly moves vertically only so as to penetrate into the skin (101) of said panel, and then moves vertically and horizontally back-and-forth so as to cut through the cellular core (102).
- 4/ A method according to claim 1 or 2, characterized in that the incision (104) is made by means of two juxtaposed serrated blades (201, 202) which vibrate relative to each other while simultaneously moving

downwards vertically relative to the plane of said panel (100) so as to penetrate into said panel by cutting through a skin (101) and through the cellular core (102) thereof.

5

5/ A method according to any one of claims 1 to 4, characterized in that the incision (104) is made in the formed panel while said panel is still in the forming mold.

10

6/ A method according to any one of claims 1 to 4, characterized in that the incision (104) is made in the formed panel outside the forming mold.

15

7/ A method of making a composite panel (100) of sandwich structure and provided with a hinge (106), said panel comprising a stack made up of at least one first skin made of a reinforced thermoplastics material, of a cellular core made of a thermoplastics material, and of a second skin made of a reinforced thermoplastics material, in which method said panel is formed by pressing said stack at a pressure lying in the range 10×10^5 Pa to 30×10^5 Pa, the first and second skins being preheated to a softening temperature, said method being characterized in that, simultaneously with the forming of said panel (101), at least a portion of an edge (109) of said panel is crushed so as to compact the cellular core (102), and the crushed portion of the edge (109) is cut out to a desired shape so as to obtain a hinge-forming piece (106) suitable for being fixed to another panel.

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30

8/ A method according to claim 7, characterized in that the portion of the crushed edge (109) is cut out at the end of forming of said panel (100).

35

9/ A method according to claim 7, characterized in that the portion of the crushed edge (109) is cut out immediately after said panel (100) has been formed.

5 10/ A method according to any preceding claim, characterized in that, prior to forming said panel (100) a pre-assembly constituted by the stack of at least the first skin (101), of the cellular core (102) and of the second skin (103) is heated.

10

11/ A method according to any one of claims 1 to 10, characterized in that, while said panel (100) is being formed, the first and second skins (101, 103) have a forming temperature lying approximately in the range
15 160°C to 200°C.

15

12/ A method according to any one of claims 1 to 11, said method being characterized in that the first and second skins (101, 103) are made up of glass fiber fabric and of
20 a thermoplastics material.

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13/ A method according to claim 12, characterized in that the thermoplastics material is a polyolefin and preferably polypropylene.

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14/ A method according to any one of claims 1 to 13, characterized in that the cellular core (102) of the panel (100) has an open-celled structure of the tubular or honeycomb cell type.

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15/ A panel (100) of sandwich-type composite structure and comprising a stack made up of at least a first skin (101) made of a reinforced thermoplastics material, of a cellular core (102) made of a thermoplastics material,
35 and of a second skin (103) made of a reinforced thermoplastics material, the panel being provided with at

35

least one hinge, and being made by implementing the method according to any one of claims 1 to 14.



A B S T R A C T

A METHOD OF MAKING A SANDWICH-TYPE COMPOSITE PANEL HAVING
A HINGE, AND A PANEL OBTAINED BY PERFORMING SUCH A METHOD

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The invention relates to a method of making a
composite panel (100) of sandwich structure and provided
with a hinge (106), said panel comprising a stack made up
of at least one first skin (101) made of a reinforced
thermoplastics material, of a cellular core (102) made of
a thermoplastics material, and of a second skin (103)
made of a thermoplastics material, in which method said
panel (100) is formed by pressing said stack at a
pressure lying in the range 10×10^5 Pa to 30×10^5 Pa,
the first and second skins (101, 103) being preheated to
a softening temperature. The invention is characterized
in that, after said panel has been formed, an incision is
made at a determined place in said panel so as to cut
through one (101) of the first and second skins (101,
103), and substantially through the entire thickness of
the cellular core, while leaving the other skin (103)
intact so that it forms, at said place, the hinge (106)
between two portions (107, 108) of the incised
panel (100).

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Translation of the title and the abstract as they were when originally filed by the
Applicant. No account has been taken of any changes that may have been made
subsequently by the PCT Authorities acting ex officio, e.g. under PCT Rules 37.2,
38.2, and/or 48.3.

1 / 1

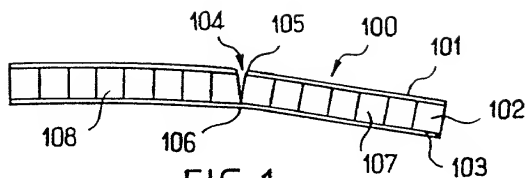


FIG. 1

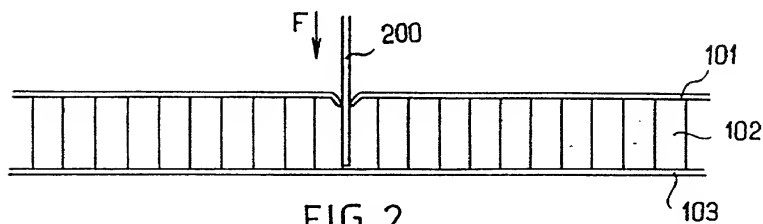


FIG. 2

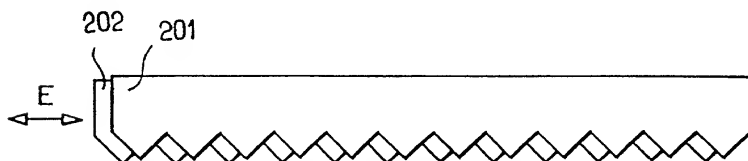


FIG. 3

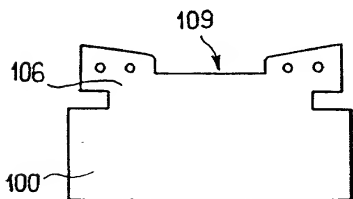


FIG. 4

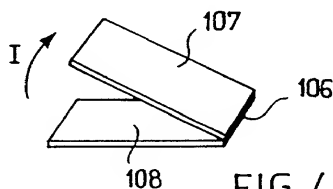


FIG. 5

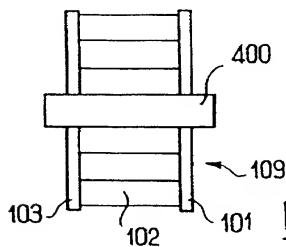


FIG. 6a

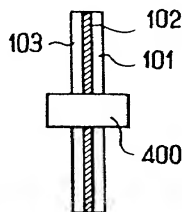


FIG. 7a

DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY

Atty. Docket No. VEI0318PUSA
First Named Inventor Nicolas Hochet

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

**A METHOD OF MAKING A SANDWICH-TYPE COMPOSITE PANEL HAVING A HINGE,
AND A PANEL OBTAINED BY PERFORMING SUCH A METHOD**

the specification of which:

[] is attached hereto; or
[X] was filed on 08 APRIL 1999 as U.S. Application Number or PCT International Application Number PCT/FR99/00811 and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below, and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Priority Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached? (Yes/No)
<u>98/04556</u>	<u>FRANCE</u>	<u>04/10/98</u>	<u>CLAIMED</u>	<u>NO</u>

I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below.

Application Number(s)	Filing Date (MM/DD/YYYY)

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56 which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

Application Number(s)	Filing Date (MM/DD/YYYY)	Status: Patented, Pending, Abandoned

Declaration for Patent Application (cont'd.)

Atty. Docket No. VEI0318PUSA

I hereby appoint the following registered practitioners to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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